

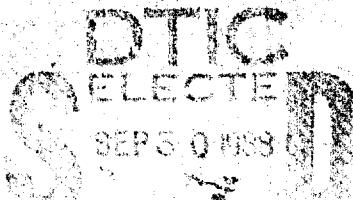
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# A REVIEW OF PSYCHOLOGICAL STUDIES IN THE U. S. ANTARCTIC PROGRAMME

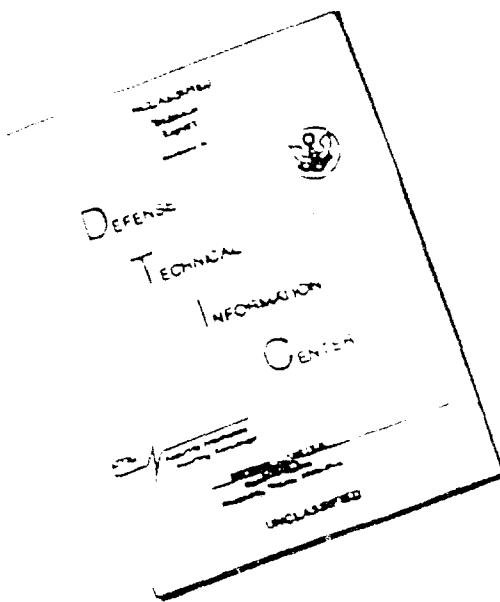
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## SUMMARY

Psychological studies were initiated at U.S. Antarctic stations during the International Geophysical Year of 1957-58. Attitude and symptom questionnaires, supervisor ratings, and sociometric test were administered to several wintering groups. A more comprehensive program of psychological studies, designed to develop selection criteria for screening Antarctic personnel, was instituted in 1962 by the U.S. Navy. A general concept of individual performance or adjustment emerged from earlier studies that included three essential components: task motivation, emotional stability, and social compatibility. Two methods, supervisor ratings and peer nominations, were used to measure these behavior components, and convergent and discriminant validities were evaluated. Regression equations were then developed to predict each behavior factor for each of three occupational groups, Navy construction personnel, Navy Administrative and technical personnel, and civilian scientists. Recent studies have focused on the impact of wintering-over stresses on long-term health and adjustment of participants. The winter-over experience does not place Navy Personnel at increased risk of hospitalization after their return from the Antarctic. The stressors associated with prolonged isolation in a harsh environment appear to be mediated by personality, environmental, and sociocultural factors. Antarctic psychological research may have significant implications for design of space stations and extraterrestrial exploration. (SD,1)

**A Review of Psychological Studies  
in the U.S. Antarctic Programme**

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**Introduction**

The Antarctic continent is the most hostile environment continuously inhabited by man. The Amundsen-Scott station at the South Pole is located at the exact geographical pole at about 10,000 above sea level on top of an ice sheet almost 10,000 feet thick. Temperatures have fallen below 100 degrees below zero Fahrenheit, and winds of more than 100 miles per hour have been recorded. At the South Pole there is one day and one night per year. The station is completely isolated and inaccessible from the outside world, except for intermittent radio communication from February until November. Conditions at other stations are less extreme, but all groups are completely isolated and confined to close quarters for many months, facing danger, deprivation, restricted activity, and periods of inevitable monotony.

Because of the prolonged isolation and unique psychosocial stresses encountered, Antarctica has been described as a "natural laboratory for the social and behavioral sciences" (1, 2). It has been suggested that the Antarctic provides a useful analogue for some aspects of future space station operations and extraterrestrial exploration (3).

Psychological studies were initiated at Antarctic stations during the International Geophysical Year (IGY), 1957 - 1958, and the Navy has conducted clinical screening of Operation Deep Freeze candidates for many years. The validity of such clinical methods for predicting human adjustment or performance in stressful environments has been questioned by many investigators.

Meehl, more than three decades ago, suggested that prediction based on clinical judgments often err because the clinician does not know what weights to give the available information nor how to combine the various cues efficiently (4). Hunt, some years later, expressed the view that objective or quasi-experimental approaches to analysis of clinical judgments might result in better validities (5).

During the first two years of Antarctic screening, that is, during the IGY, ratings by psychiatrists and psychologists were very successful in predicting performance in Antarctica as measured by supervisor and peer evaluations at the end of winter. Correlations in the range of .40 and .60 were obtained between clinicians' ratings made at the time of screening and supervisor-peer evaluations of performance at the end of the Antarctic winter.

This degree of success in prediction was apparently achieved for two reasons: (1) there was a wide range in quality among personnel screened, and (2) the clinicians' ratings were completely disregarded. For example, at one Antarctic station in 1957, just over one-half of the station members had been recommended for disqualification at screening on the basis of emotional instability; that station had more conflict among members and between members and the station leader than any other U.S. Antarctic group that has ever been studied (6). During the years immediately following the IGY, clinicians' recommendations generally were heeded, and persons with manifestly pathological personalities were usually screened out before deployment. Under these circumstances the predictions of adjustment rendered by clinicians had little or no correlation with later reports of supervisors and peers.

Early in our research programme we recognized that criteria of individual effectiveness or adjustment must be related to the general concept of organizational purpose. Job performance

criteria were constructed by identifying job behaviours that are related to the accomplishment of organizational goals and quantifying these behaviors so they could reflect individual differences in performance.

The measurement of job performance in the Antarctic was difficult because each of several occupational specialties represented at the small stations had many different tasks to perform, and it was impossible to know in advance how much work would be required in a given specialty or what disruptions might occur due to factors beyond the individual's control. The only available source of information about an individual's work behaviour was the station membership itself, so it seemed clear that assessment of work performance and other behaviour areas could only be achieved in this type of isolated community by seeking a consensus of leaders and group members.

Earlier studies resulted in a general concept of effective individual performance which included three essential components: task motivation, emotional stability, and social compatibility. Measures of the three trait areas by two methods (supervisor ratings and peer nominations) were intercorrelated in several samples and interpreted in terms of the Campbell and Fiske (4) model for evaluation of convergent and discriminant validities. The results were encouraging because of the stability in validities from one sample to another. Furthermore, the behaviour factors appeared to be equivalent to those reported by other investigators (7, 8).

After demonstrating reasonably good agreement between supervisor and peer evaluations, regression equations were developed to predict each behaviour factor for each of three occupational groups: Navy construction personnel, Navy administrative and technical personnel, and civilian scientists. Scores on the task, social, and emotional criteria were derived for each new Antarctic applicant, and candidates in each major

job category (e.g., radio operator) were rank ordered on the predicted scores. It was then possible to determine an individual's standing within his occupational group on predicted Antarctic performance and to consider this information along with all other relevant data in making a final decision about suitability to winter-over.

Certain difficulties became apparent as we attempted to develop prediction equations based upon a wide variety of screening variables including biographical information, attitude and personality scales, clinical evaluations, and symptom inventories. Repeated studies had indicated specific relationships between screening predictors and performance criteria depending upon the occupational group studied. In other words, specific biographical and personality data that correlated with emotional stability for Navy construction personnel did not predict the same criterion for civilian scientists, and vice versa. Occupations, or culture, was a moderator in predicting adjustment. Also, it was not certain that the occupational groupings that we had used in prediction studies were indeed internally homogeneous or uniquely different from each other. We used the McQuitty and Clark method of clustering to provide a basis for more confidence in our a priori grouping (9).

A second difficulty that confronted us was reliance on supervisor ratings as a primary source of criterion information. Many investigators have criticized such use because of halo effects, response style or leniency effects, and rater generosity. One method of gathering criterion information has definite advantages, the peer nomination or sociometric technique. Peer nominations are simple to administer and have high reliability. The peer nomination items that were most important as performance criteria in Antarctic studies were the following:

Name FIVE men at this station who seemed to be most industrious and hardest working in carrying out their jobs and other tasks around the station.

Name FIVE men at this station who seemed to be most calm and even-tempered even in frustrating or emergency situations.

Name FIVE men who seemed to be friendliest and most popular among most the station members.

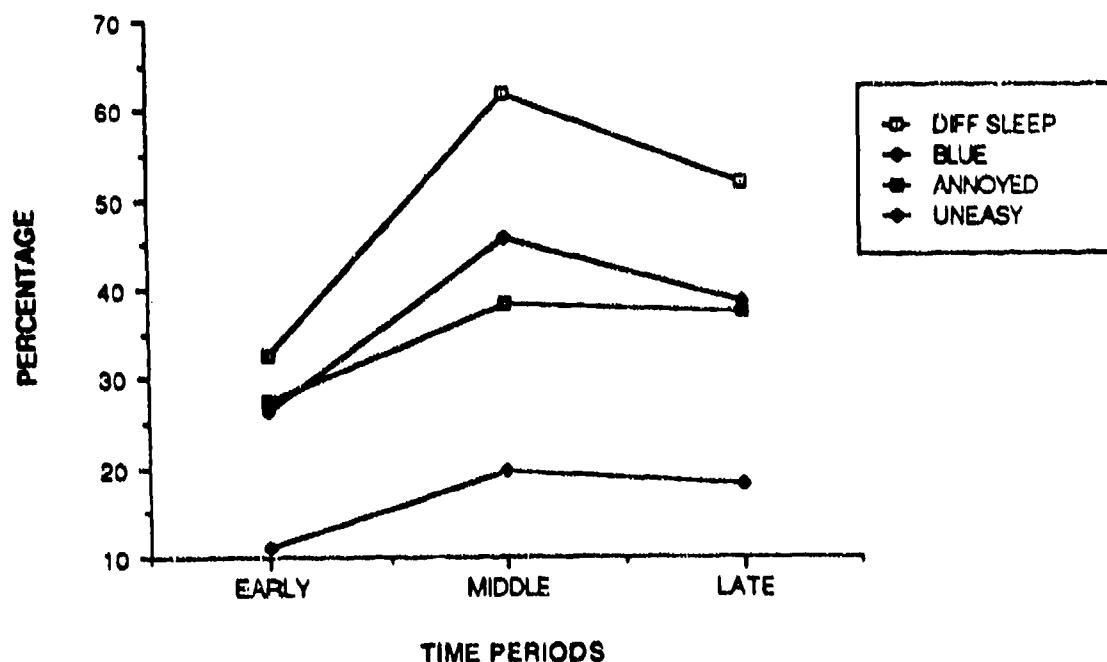
If you were given the task of selecting men to winter-over at a small station, which FIVE men from this station would you choose first?

The first three items represent the three basic components of individual effectiveness and the fourth item represents a general concept of effectiveness. Peer nominations were administered only at the end of winter and only positive, that is, favorable evaluations, were requested. Relatively few station members refused to provide nominations, and these refusals did not affect the overall usefulness of results.

Symptom questionnaires indicating the presence and intensities of a variety of common somatic and emotional complaints were administered by medical officers to a number of Antarctic groups on three occasions in two expeditions. The combined results for the two years in terms of the percents of station members reporting symptoms at each of the three time periods--early winter, midwinter, and late winter--are shown in Figure 1. The four representative items plotted were: "difficulty falling asleep or staying asleep", "feeling blue", "feeling easily annoyed or irritated", and "feeling uneasy without knowing why". These results indicate that there was a large increase in sleep problems by midwinter, moderate increases in depression and irritability, and a small increase in anxiety. The N's were 210 for the early period, 345 for midwinter, and 220

for late winter. Many individuals were not available at the early and late periods because of heavy work schedules. The increases in symptoms reported would be expected to have deleterious effects upon motivation, social adjustment, and work performance.

FIGURE 1. COMMON SYMPTOMS IN ANTARCTIC GROUPS



Repeated factor analyses of an attitude inventory constructed specifically for Antarctic personnel produced four scales to measure changes in job satisfaction and group effectiveness during the winter-over period. These scales were called: Job Morale, Job Importance, Group Compatibility, and Group Accomplishment.

Navy men showed significant deterioration in Job Morale from early to late winter whereas civilians showed little or no change. There was no evidence of changes in perceived Job Importance for either Navy or civilian groups.

The Group Compatibility and Group Accomplishment scales also were administered in early winter and late winter. Sample items for these scales are as follows:

**Group Compatibility**

- The men at this station work well together as a team.
- Group spirit at this station is high.
- Members of this station disagree a lot with each other (reversed).

**Group Accomplishment**

- This group does not seem to accomplish much (reversed).
- Everyone takes a lot of pride in what this group accomplishes.
- This group could achieve almost anything it sets out to do.

At early winter, civilian personnel had somewhat less favorable perceptions of group compatibility and group accomplishment than Navy personnel. At the end of winter, however, Navy personnel had less favorable attitudes on both scales. It was concluded that occupational role was an important determinant of job attitudes under conditions of long-term isolation and confinement.

During the winter months, when work activities were reduced for most station members, free time was available for hobbies and leisure activities. The use made of this time and the satisfaction or boredom experienced by the individual would be expected to affect psychological adjustment. A questionnaire

describing leisure activities was administered twice during the winter in Antarctica. There was considerable overlap among the three occupational subgroups studied in the leisure activities preferred or rejected during the winter months. All three subgroups spent much of their leisure time attending movies, discussing present jobs, and listening to popular music. The Seabees and the technical-administrative subgroup shared an interest in country-western music and in discussions of past jobs. The civilian scientists, on the other hand, spent a relatively large proportion of their leisure time listening to classical music and reading technical magazines.

There was high agreement among the three subgroups regarding the least preferred activities at early winter. Reading biographies, playing chess or checkers, reading religious literature, and painting and drawing were avoided by all three subgroups. The technical-administrative subgroup and the civilians did not like to play cards. The Seabees were unique in their avoidance of physical exercise as a leisure activity.

There did not appear to be any striking changes in leisure activities from early to late winter. There was some increase in physical exercise and in reading fiction; at the same time there was a decrease in the popularity of classical music with Navy personnel. In general, the most popular activities in early winter retained their popularity throughout the winter.

Most of the research to date on the effects of prolonged exposure to the Antarctic environment has focused on psychological changes that have occurred during the winter-over period. A number of studies also have reported physiological changes; for example, a rash of upper respiratory infections and colds among winter-over personnel have been noted at the opening of stations to outsiders (10, 11, 12). This has been attributed to an immunosuppressed state of winter-over personnel due to the climate, psychological stress, and absence of viral agents (13,

14). Sleep studies also have demonstrated that South Polar Plateau subjects lose all stage IV sleep as well as significant amounts of stage III and REM. The restoration of a standard sleep EEG pattern has required as long as 24 months after return from a year in the Antarctic (15).

A series of studies conducted at the Naval Health Research Center (16, 17, 18, 19, 20) have shown that enlisted Navy personnel who wintered-over between 1963 and 1974 exhibited significantly fewer subsequent first hospitalizations than a control group of enlisted personnel who were accepted for winter-duty but who were assigned elsewhere. The decreased risk of subsequent disease and injury was observed for total first hospitalizations; neoplasms; endocrine, nutritional, and metabolic diseases, and diseases of the musculoskeletal system (17). When these rates were examined by six-month intervals, an increase in the rate of first hospitalization was observed, peaking at approximately nine months after returning from the Antarctic. However, this increase did not place them at risk when compared with the control group. Moreover, the relative risk declined significantly after this period of readjustment (18).

Several alternative explanations have been offered to account for this finding, but one of the most intriguing possibilities is that winter-over personnel may derive positive benefits from the experience enabling them to cope with subsequent stressful life events and reduce the long-term risk of illness and disease.

Certain psychosocial characteristics of winter-over personnel have been found to be independently associated with decreased risk of first hospitalizations, i.e., control over others, achievement need, and education (20). However, when differences in pre-Antarctic personality measures were controlled for, the winter-over group continued to display significantly fewer first hospitalizations subsequent to Antarctic duty than the control

group. This led to speculation that winter-over personnel develop coping strategies while on the ice, enabling them to cope better with subsequent stressful experiences.

Currently, the Division of Polar Programs of the National Science Foundation is funding a five-year programme of research on adaptation and health in Antarctic winter-over personnel. The research has two specific objectives. The first is to conduct an ethnographic study of adaptation in an Antarctic station to identify processes of social interaction, extent of social support in coping with stress, and methods of adjustment to the winter-over syndrome. Our primary hypothesis is that the microcultures of Antarctic research stations provide a paradigm for individual adjustment as well as group adaptation by defining normative and pragmatic means for coping with the stresses associated with prolonged isolation in an extreme environment.

The second major objective is to conduct a longitudinal study of coping strategies among winter-over personnel to determine if these measures change significantly after the winter-over period and reflect either an enhancement of existing methods for coping with stressful life experiences or the development of new methods which differ from those exhibited by a control group. Our primary hypothesis is that the resistance resources and coping strategies of winter-over personnel will be significantly different from those of a control group. The study cohort will consist of personnel evaluated for winter-over duty. The cohort will be divided into two groups: those who winter-over and those who spend the austral summer in Antarctica but do not winter-over.

It is believed that Antarctica can continue to be an important source of information on human adaptation and health in an extreme environment.

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